CLAIMS:

1. A method of facilitating a process performed by a semiconductor processing tool, comprising:

inputting data relating to a process performed by the semiconductor processing tool;

inputting a first principles physical model relating to the semiconductor processing tool;

performing first principles simulation using the input data and the physical model to provide a virtual sensor measurement relating to the process performed by the semiconductor processing tool; and

using the virtual sensor measurement to facilitate the process performed by the semiconductor processing tool.

2. The method of Claim 1, wherein said inputting comprises directly inputting the data relating to a process performed by the semiconductor processing tool from at least one of a physical sensor and a metrology tool physically mounted on the semiconductor processing tool.

3. The method of Claim 1, wherein said inputting comprises indirectly inputting the data relating to a process performed by the semiconductor processing tool from at least one of a manual input device and a database.

4. The method of Claim 3, wherein said indirectly inputting comprises inputting data recorded from a process previously performed by the semiconductor processing tool.

5. The method of Claim 3, wherein said indirectly inputting comprises inputting data set by a simulation operator.

6. The method of Claim 1, wherein said inputting data comprises inputting data relating to at least one of the physical characteristics of the semiconductor processing tool and the semiconductor tool environment.

7. The method of Claim 1, wherein said inputting data comprises inputting data relating to at least one of a characteristic and a result of a process performed by the semiconductor processing tool.

8. The method of Claim 1, wherein said inputting a first principles physical model comprises inputting a spatially resolved model of the geometry of the semiconductor processing tool.

9. The method of Claim 1, wherein said inputting a first principles physical model comprises inputting fundamental equations necessary to perform first principles simulation to obtain a virtual sensor reading .

10. The method of Claim 1, wherein said performing first principles simulation comprises performing first principles simulation concurrently with the process performed by the semiconductor processing tool.

11. The method of Claim 10, further comprising:
    repeatedly updating the data from the physical sensor or metrology tool during the semiconductor process;
    repeatedly performing the first principles simulation using the updated data during the semiconductor process;
    facilitating the semiconductor process concurrently with running the semiconductor process based on virtual sensor measurements obtained during the semiconductor process.

12. The method of Claim 10, further comprising:
    setting boundary conditions for the first principles simulation prior to a start of the semiconductor process;
    performing a time dependent simulation of the semiconductor process during the semiconductor process and without direct input from the semiconductor process; and

facilitating the semiconductor process concurrently with running the semiconductor process based on virtual sensor measurements obtained during the semiconductor process.

13. The method of Claim 1, wherein said performing first principles simulation comprises performing first principles simulation not concurrently with the process performed by the semiconductor processing tool.

14. The method of Claim 13, wherein said inputting data comprises inputting at least one of initial and boundary conditions of said first principles simulation recorded from a process previously performed.

15. The method of Claim 3, wherein said indirectly inputting comprises inputting best known input parameters for the physical model.

16. The method of Claim 15, further comprising:

comparing said virtual sensor measurements with actual sensor measurements; and

refining at least one of the best known input parameters and the physical model to obtain better agreement between the virtual sensor measurements with actual sensor measurements.

17. The method of Claim 1, wherein said using the virtual sensor measurement comprises using the virtual sensor measurement to characterize the process performed by the semiconductor processing tool.

18. The method of Claim 1, wherein said using the virtual sensor measurement comprises using the virtual sensor measurement to control the process performed by the semiconductor processing tool.

19. The method of Claim 1, wherein said using the virtual sensor measurement comprises using the virtual sensor measurement to detect a fault in the process performed by the semiconductor processing tool.

20. The method of Claim 1, further comprising storing the virtual sensor measurement in a library for subsequent use in a first principles simulation.

21. The method of Claim 1, further comprising using a network of interconnected resources to perform at least one of the process steps recited in Claim 1.

22. The method of Claim 21, further comprising using code parallelization among interconnected computational resources to share the computational load of the first principles simulation.

23. The method of Claim 21, further comprising sharing simulation information among interconnected resources to facilitate a process performed by the semiconductor processing tool.

24. The method of Claim 23, wherein said sharing simulation information comprises distributing simulation results among the interconnected resources to reduce redundant execution of substantially similar first principles simulations by different resources.

25. The method of Claim 23, wherein said sharing simulation information comprises distributing model changes among the interconnected resources to reduce redundant refinements of first principles simulations by different resources.

26. The method of Claim 21, further comprising using remote resources via a wide area network to facilitate the semiconductor process performed by the semiconductor processing tool.

27. The method of Claim 26, wherein said using remote resources comprises using at least one of remote computational and storage resources via a wide area network to facilitate the semiconductor process performed by the semiconductor processing tool.

28. A system comprising:
a semiconductor processing tool configured to perform a process;

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an input device configured to input data relating to the process performed by the semiconductor processing tool; and

a first principles simulation processor configured to:

input a first principles physical model relating to the semiconductor processing tool, and

perform first principles simulation using the input data and the physical model to provide a virtual sensor measurement relating to the process performed by the semiconductor processing tool, wherein the virtual sensor measurement is used to facilitate the process performed by the semiconductor processing tool.

29. The system of Claim 28, wherein said input device comprises at least one of a physical sensor and a metrology tool physically mounted on the semiconductor processing tool.

30. The system of Claim 28, wherein said input device comprises at least one of a manual input device and a database.

31. The system of Claim 30, wherein said input device is configured to input data recorded from a process previously performed by the semiconductor processing tool.

32. The system of Claim 30, wherein said input device is configured to input data set by a simulation operator.

33. The system of Claim 28, wherein said input device is configured to input data relating to at least one of the physical characteristics of the semiconductor processing tool and the semiconductor tool environment.

34. The system of Claim 28, wherein said input device is configured to input data relating to at least one of a characteristic and a result of a process performed by the semiconductor processing tool.

35. The system of Claim 28, wherein said processor is configured to input a first principles physical model comprising a spatially resolved model of the geometry of the semiconductor processing tool.

36. The system of Claim 28, wherein said processor is configured to input a first principles physical model comprising fundamental equations necessary to perform first principles simulation to obtain a virtual sensor reading.

37. The system of Claim 28, wherein said processor is configured to perform said first principles simulation concurrently with the process performed by the semiconductor processing tool.

38. The system of Claim 37, wherein said processor is further configured to:
    repeatedly update the data from the physical sensor or metrology tool during the semiconductor process; and
    repeatedly perform the first principles simulation using the updated data during the semiconductor process, wherein the semiconductor process is facilitated concurrently with running the semiconductor process based on virtual sensor measurements obtained during the semiconductor process.

39. The system of Claim 37, wherein said processor is further configured to:
    set boundary conditions for the first principles simulation prior to a start of the semiconductor process; and
    perform a time dependent simulation of the semiconductor process during the semiconductor process and without direct input from the semiconductor process, wherein the semiconductor process is facilitated concurrently with running the semiconductor process based on virtual sensor measurements obtained during the semiconductor process.

40. The system of Claim 28, wherein said processor is configured to perform said first principles simulation not concurrently with the process performed by the semiconductor processing tool.

41. The system of Claim 40, wherein said processor is configured to perform said first principles simulation at least by using the input data to set at least one of initial and boundary conditions of said first principles simulation recorded from a process previously performed.

42. The system of Claim 30, wherein said input device is configured to input best known input parameters for the physical model.

43. The system of Claim 42, wherein said processor is configured to:

compare said virtual sensor measurements with actual sensor measurements; and

refine at least one of the best known input parameters and the physical model to obtain better agreement between the virtual sensor measurements with actual sensor measurements.

44. The system of Claim 28, wherein said virtual sensor measurement is used to characterize the process performed by the semiconductor processing tool.

45. The system of Claim 28, wherein said virtual sensor measurement is used to control the process performed by the semiconductor processing tool.

46. The system of Claim 28, wherein said virtual sensor measurement to is used detect a fault in the process performed by the semiconductor processing tool.

47. The system of Claim 28, wherein said processor is further configured to store the virtual sensor measurement in a library for subsequent use in a first principles simulation.

48. The system of Claim 28, further comprising a network of interconnected resources connected to said processor and configured to assist said processor in performing at least one of the inputting a first principles simulation model and performing a first principles simulation.

49. The system of Claim 48, wherein said network of interconnected resources is configured to use code parallelization with said processor to share the computational load of the first principles simulation.

50. The system of Claim 48, wherein said network of interconnected resources is configured to share simulation information with said processor to facilitate said process performed by the semiconductor processing tool.

51. The system of Claim 50, wherein said network of interconnected resources is configured to distribute simulation results to said processor to reduce redundant execution of substantially similar first principles simulations.

52. The system of Claim 50, wherein said network of interconnected resources is configured to distribute model changes to said processor to reduce redundant refinements of first principles simulations.

53. The system of Claim 48, further comprising remote resources connected to said processor via a wide area network and configured to facilitate the semiconductor process performed by the semiconductor processing tool.

54. The system of Claim 53, wherein said remote resources comprise at least one of a computational and a storage resource.

55. A system for facilitating a process performed by a semiconductor processing tool, comprising:

means for inputting data relating to a process performed by the semiconductor processing tool;

means for inputting a first principles physical model relating to the semiconductor processing tool;

means for performing first principles simulation using the input data and the physical model to provide a virtual sensor measurement relating to the process performed by the semiconductor processing tool; and

means for using the virtual sensor measurement to facilitate the process performed by the semiconductor processing tool.

56. The system of Claim 55, wherein said means for performing first principles simulation comprises means for performing first principles simulation concurrently with the process performed by the semiconductor processing tool.

57. The system of Claim 56, further comprising:

means for repeatedly updating the data from the physical sensor or metrology tool during the semiconductor process;

means for repeatedly performing the first principles simulation using the updated data during the semiconductor process;

means for facilitating the semiconductor process concurrently with running the semiconductor process based on virtual sensor measurements obtained during the semiconductor process.

58. The system of Claim 56, further comprising:

means for setting boundary conditions for the first principles simulation prior to a start of the semiconductor process;

means for performing a time dependent simulation of the semiconductor process during the semiconductor process and without direct input from the semiconductor process; and

means for facilitating the semiconductor process concurrently with running the semiconductor process based on virtual sensor measurements obtained during the semiconductor process.

59. The system of Claim 55, further comprising means for inputting best known input parameters for the physical model, said system further comprising:

means for comparing said virtual sensor measurements with actual sensor measurements; and

means for refining at least one of the best known input parameters and the physical model to obtain better agreement between the virtual sensor measurements with actual sensor measurements.

60. The system of Claim 55, further comprising means for sharing the computational load of the first principles simulation.

61. The system of Claim 41, further comprising means for sharing simulation information among interconnected resources to facilitate a process performed by the semiconductor processing tool.

62. A computer readable medium containing program instructions for execution on a processor, which when executed by the computer system, cause the processor to perform the steps of:

inputting data relating to a process performed by a semiconductor processing tool;

inputting a first principles physical model relating to the semiconductor processing tool;

performing first principles simulation using the input data and the physical model to provide a virtual sensor measurement relating to the process performed by the semiconductor processing tool; and

using the virtual sensor measurement to facilitate the process performed by the semiconductor processing tool.